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THE EVOLUTION OF AIM AND METHOD IN THE TEACHING OF NATURE-STUDY IN THE COM- MON SCHOOLS OF THE UNITED STATES (*Concluded*)

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In 1845, in the higher schools the idea of study for the sake of discipline became a prominent factor in the work, and science, especially botany, held its place because of its disciplinary value. In the elementary schools all organized attempts to teach natural history practically died out. In the meantime geography had gained considerable headway and the description of landscape, plants, and animals as incorporated in this study was considered ample natural history for the elementary schools. School work settled down to a study routine in which anyone who could handle the system, diagram, work all of the sums, and keep order was ready to teach. Against the character and content of this type of work in elementary schools people soon began to complain. Both Gray and Agassiz, the recognized leaders of their respective sciences, raised their voices in protest. Gray said:

I do not suppose that the mere treasuring up of facts will effect the object of education. . . . I venture the assertion that, if the truth were known, the child acquires a greater number of useful ideas, more real development and strength of mind, during his play hours with his rabbits, his kites, from his story books, than from the lessons assigned him during his hours of study; he is really educated more out of school than in school.

By the early fifties a new movement was attempted and a strong plea made for a return to a freer out-of-door study of nature from the standpoint of the child's interests. The movement in America seems to have been stimulated by the work of the Prussian schools and its spirit is fairly stated by Raumer:

I will state the method which the student should follow: He should first examine in all directions the neighborhood of his residence and should make himself so thoroughly familiar with it that he can call up before his

mind whatever he chooses. Such an acquaintance is the result of the unconscious and fresh pleasures which youth, joyful and free from scientific anxieties, will find for itself in such an examination, obtaining in this artless way a simple, general impression of the vicinity not forced by the teacher. He is not teased while rejoicing in the blue heavens and the rapid motion of the clouds, in the oak woods, and flowery meadows, where the butterflies play, by a professor with a kianometer to measure the blue of the sky, nor by recommendations not to stare in the woods but rather to ascertain whether the oaks are *Quercus rubra* or *alba*; or, not to look at the flowers all at once as if they were a yellow carpet but to take his Linnaeus and determine the species of *Ranunculus*. No entomologist is setting him to chase butterflies and to impale them. . . . In this paradisaic pleasure is planted the seed of the perception of an intellectual world, whose secrets will not be fully ascertained and understood even after the longest and most active life of scientific effort. But most teachers, by the dispersion of these simple impressions of nature, destroy these earlier impressions of children and the brightness of the imaginary world which they see.

This second movement for a return to nature from the standpoint of children's interest had made but little headway when it was intercepted by another and stronger movement. Two ideas had grown up in school work, both at home and abroad, and become associated with nature teaching. One was that of mental discipline, already prominent in the science work of the higher schools; the other, that of acquiring practical or useful information, some knowledge of the natural and manufactured objects met and used in everyday life. The first idea gave rise to a type of teaching termed "object-lessons," the primary purpose of which was sense-training, mental exercise, and discipline. It called for a complete and detailed analysis of an object to insure complete observation and accurate judgment. Its advocates believed that the end, mental discipline, could be most effectively attained through an intensive study of a few type objects. The second idea gave rise to a type of instruction termed, "Lessons on Common Things," and was intended to give children information on common materials and phenomena about them from the standpoint of meaning, their use to man, and something of the processes by which they are rendered useful. So far as relates to any natural history in the common schools

these two types of work held and dominated the field during the succeeding thirty years (1860-90).

The conflict brought on by the growth of the idea of organic evolution was a strong factor in silencing any plea for a return to pure natural-history study in the common schools. "Its enemies are those who are sneering at 'bugology' or who lift their hands in pious horror because some bold speculator or lover of notoriety thinks geology contradicts the Bible." It was only when organic evolution had gained a stronghold in the minds of the more liberal thinking public that a return to a study of nature, from the standpoint of the child's interests in nature, could be attempted. Taking a glimpse at the higher schools and academies during this period, botany in the form of plant analysis and textbook memorization still held sway. A little before the middle of the period, under the masterful guidance and leadership of Huxley and his followers, as well as on account of the rapid growth in biological knowledge, zoölogy began to gain prominence in the more progressive schools. Up to this period the school work in zoölogy was of the strictly natural-history type.

In 1872 Huxley remarked:

Certain broad laws of biology have a general application throughout the animal and plant world, but the ground common to these kingdoms of nature is not of very wide extent, and the multiplicity of details so great that the student of living beings finds himself obliged to devote his attention to one or the other.

This marks the first distinct step toward specialized study. To this Huxley added the remark which gave direction to this work for the succeeding sixteen years:

My own impression is that the best model for all kinds of training in physical science is that afforded by the methods of the study of anatomy in the medical schools.

It is not necessary to point out that the study has made a direct shift in the schools from the viewpoint of the educator to that of the specialist in a particular subject. The pupil is now treated in his class work exactly as he would be if he were preparing himself as a specialist in zoölogy, except that he shall

stop the study with the job half completed. On the other hand it was assumed that under the influence of this work, as carried on, the aims of the educator, interest, discipline, character, moral culture, would follow as a matter of course; and educational discussions turned to a discussion of the relations of science to "discipline," to "moral culture," to "character-building," etc. Natural-history types of work quite wholly disappeared from the schools and specialized types of work took their place. Pupils analyzed, observed, dissected, not from any impulse of intense individual interest but because the laboratory manual so directed. This work reached its culmination in Huxley and Martin's *Practical Biology*.

In the beginning stages of the work classification was the foundation upon which the work was based; later morphological work became the prominent factor, especially in zoölogy, and classification was transferred to the back of the book, the argument being that children should first have something to classify. The work in the sciences, as well as the "object-lessons" and "lessons on common things," in the elementary schools had just reached perfection in organization of subject-matter, perfect textbooks had been written, and the schools were well settled to their routine work, when the complaint began again to grow that "science and object-lessons as taught are becoming a grind and destroying the children's instinctive interests in natural objects and phenomena."

The late seventies and early eighties stand out as a transition period during which elementary science and object-lessons made up the bulk of the nature-teaching in the schools, but enthusiasm was on the wane, there was a growing remonstrance against the type of work carried on in both schools, and centers of work of a new character were forming in various localities. Under the influence of the teachings of Pestalozzi and his followers the feeling that the child's education should deal more with things, from the standpoint of his interest, and less with books, had been kept alive and gained considerable headway, notwithstanding that object-lesson teaching had proved that the study of things could become as formal a process in learning

as the textbook when things were not considered from the standpoint of the pupils' interests. From the other side had come the growing influence of science, convincing the people that it held something better than routine analysis and classification.

As might be expected the better elements of both took a prominent part in the movement now in its formative stage. This movement was distinctly an American movement, brought on by American school conditions; whereas previous movements were made up largely of elements borrowed from foreign countries and applied to American conditions. Three of the centers in this new movement are cited as typical of the influences which entered into it.

One of these centers is represented by the work of Alpheus Hyatt and Lucretia Crocker around Boston. Professor Hyatt was a student and follower of Agassiz and his work partook of the point of view of science. The character of this work is well represented in his *Guides for Science Teaching* (1878). I am inclined to believe that had the elementary schools, during this earlier period held to the spirit of Agassiz' teachings they would have accomplished far more in their work.

At about this same time (1877-78) Dr. W. T. Harris was trying out a course in elementary science in the schools of St. Louis. In his introductory remarks to the teacher he says: "The course is arranged with reference to method rather than quantity and exhaustiveness." He thought out the course as progressing spirally: plant life in the first grade, animal life in the second grade, physical elements and mechanical powers in the third grade, coming around to botany again in the fourth grade. Referring to botany he says:

If only one topic is thoroughly discussed in each quarter of the year some very important ideas will be gained of the science of botany. In the fourth year the student will come round to the subject again and can deepen his insight into the methods of studying the world of plants, learn the general outline of classification, and train his observing powers.

It is evident that Dr. Harris had in mind, as the aim in the work, discipline and preparation for science. At the third level

of the rounding of the spiral these more general topics merge into the more general elementary sciences: in the sixth grade, into elementary physics and astronomy; in the seventh grade, physical geography; and in the eighth grade, natural philosophy.

In the meantime Professor H. H. Straight was developing a type of work in the Oswego normal school (1878-82).¹ Professor Straight was a student under Agassiz and was well grounded in the sciences. On the other side he had become greatly influenced by the teachings of Pestalozzi, and in his work he blended in an admirable way these two points of view. I consider that this work, more than any other, represented in spirit and practice this new nature-study movement. Similar types of work were advocated and carried on in other localities, among which may be mentioned the work of Boyden in Plymouth Co., Mass., Payne in Pennsylvania, Ford at Kirksville, Mo., Howe at Chicago, etc. But, so far as I have been able to analyze the situation, no new elements entered into any of these other centers.

During the late eighties Professor Wilbur S. Jackman had been studying the science-teaching problem as related to high-school work; he had outlined a course of study which he asked, and was granted, permission to carry out in the Central High School of Pittsburgh. Before the course went into effect he was called to the Cook County Normal School to take up the work interrupted by the death of Professor Straight. With the work of Professor Straight to open the way, under the leadership of Colonel Parker and with a broad, sympathetic, liberal, thinking mind of his own, the outlook was for strong and effective work.

Up to this period (1891) the thing lacking to fuse this new work into one great movement was a good textbook or guide for teachers. Numerous outlines had appeared in educational journals and in pamphlet form, but they were scattered and showed little unity of opinion. In the latter part of the year Mr. Jackman issued his *Nature-Study*. The time for a book was never more ripe; no book ever met so directly the spirit of the

¹ He was called to Cook County Normal School, 1883-85.

movement which it represented, and yet it proved a sore disappointment to teachers. It met the teachers unprepared, it treated of outlook, of purpose, of methods of setting to work with the children, of what was best to do and how to do it; but alas, it failed to tell the teacher what the results would be after she had done the work, it failed to give the answer to the questions asked. For a quarter of a century the schools had preached "study things and not books," had handled and taught from objects in both science and object-lessons, under the impression that they were studying things, and when the students of the system were put to the test it was found, *en masse*, to have been dead formalism. That the proper doing of a thing would furnish the answer, that if it did not it was because the method of the doing was wrong, and needed correction, did not occur to the school world. It made little difference what the nature of the activity was, or the incentive under which carried on, it was *an* answer that was wanted and as stated by a supervisor of nature-study, "I don't need a book that asks questions, I want one that contains answers." The book indicated a direct return to the original and ever-recurring idea of bringing children into direct contact with the whole of their nature environment from the standpoint of their own interests in nature. The underlying idea was no longer that of the "Wonders of Creation," but the writer states:

The spirit of nature-study demands that children shall be intelligently directed in an investigation of their nature environment; that there shall be, under the natural stimulus of the desire to know, a constant effort at a rational interpretation of the common things observed.

Mr. Jackman doubtless believed that the work adequately carried out would usher the grade pupil, well prepared in spirit, subject-matter, and methods of work, into the sciences of the high school. The movement during the next fifteen years (1890-1905) affords an interesting study in which to trace out the influences which have side-tracked true ideals in elementary education, in order to make room for special interests.

The absence of information in Mr. Jackman's book was remedied two years later (1894) by Howe's *Systematic Science Teaching*. In method this book should have preceded Mr. Jack-

man's, since it shows clearly a direct transition from object-teaching; in another respect that it should follow was the proper procedure. It covers the whole range of the nature environment, starts from the standpoint of children's interests, tells the teacher what to do and how to do it, but gives sufficient running information to relieve the teacher of the necessity to find out anything for herself in the way of original observation and inference.

In the meantime there grew up a general feeling that—

Nothing appeals so strongly to the young child as life, and when associated with color and movement the appeal is almost irresistible. Change in weather, the formation and nature of soil, minerals and rocks, the effects of erosion and a host of other phenomena of great interest makes no such an appeal, does not enter so apparently and directly into child life, and can be left with safety until a later school period.

Suiting the book to the occasion we have (1898) Lange's *Handbook of Nature-Study*. It treats of plant and animal life only, reduces directions to the teacher to a minimum, except a few fine-print directions on securing materials, and fills the body of the book with a more or less complete description of individual plants and animals. The book doubtless met the demands of teachers, but that the trend is toward dead formalism is clearly indicated.

With the trend of teaching toward a study of plant and animal life, teachers found that they could secure better attention, more interest, if the work in hand assumed story form, and made an appeal to the emotional, rather than the intellectual, side of child life. At the same time there grew up a feeling that nature-study of a more primitive type, myth, folklore, as well as story, was what the child needed; and the movement took a turn in this direction. At the same time numerous excellent stories, attractive to children and adults alike, appeared and a period of story reading and telling was established. The situation was somewhat saved by the timely appearance of Hodge's *Nature-Study and Life* (1901). This book held to the plant and animal phase and recognized feelings and sentiments as powerful factors in elementary education, and approached the study from a humanistic

and economic standpoint. The book is too recent and well known to require description. Its great strength was in influencing teachers to develop the personal-interest-in-nature side of the child. To have pets, grow plants, make gardens, encourage wild bird life, use aquarium and insect houses in study of animal life, and to encourage children, and to give them opportunity to put more of themselves into the work. He did not make the mistake of Mr. Jackman in believing that the teacher should be able to go it alone, but filled in ample, excellent text as well as furnished liberally excellent references.

It is of interest to note how, in all of these movements, the popular teaching mind seizes upon some one prominent factor, pampers it, nourishes it, accentuates it until it completely dominates and distorts the situation; whereas had it been treated in a normal way, held in proper association with other equally important ideas, the whole would have exerted a pleasant, wholesome, broadening educational influence upon child life. But in the present instance the emotional stood in the forefront, caught the attention of teachers, and animal stories became the rage of the season. We were getting children into sympathetic touch with nature with a vengeance, but it was a world of nature as revealed through human fancy and not through observation and scientific research. Had we stuck to animals, observed them to see whether they verified the stories, the results might have been most profitable, but such observation spoiled the story. We had so far outstripped nature that the story was more interesting to the child than the living animal itself. Further, because of the reaction due to the overdoing of a good thing, I found parents and teachers asking whether children should be allowed to read books like Thompson-Seton's and Long's. Should a child be allowed occasionally to have a lump of sugar?

The work on the whole was beginning to generate doubt in the minds of people, and a feeling was developing that all of this work, if carried on at all in the elementary schools, should be grouped under the head of elementary science and taught in harmony with scientific method. This feeling was furthered

by numerous criticisms on results as observed in nature-study teaching of which the criticism of Professor Armstrong in the *Moseley Educational Commission Report* (1904) is typical:

The Nature-Study lessons I witnessed, when not specifically botanical or zoölogical and scientific in character, were eminently superficial and worthless.²

Up to this date there had been no co-operative effort on the part of advocates of nature-study and little attempt to define, in any broad and comprehensive way, the fundamentals of nature-study; to determine what it really is, its scope, and the character of the work which it should attempt to do. At this crisis in the situation, when people began to say that the work was "in bad repute," when eminent educators contended that it was "a dangerous fad," Professor M. A. Bigelow came to its rescue in founding the *Nature-Study Review*, secured, from various parts of the United States and Canada, through a symposium, the opinion of various people as to the nature, aim, scope, and purpose of the study, thus placing it again squarely before the teaching public and setting up anew a starting-point in nature-study. The outlook into this present epoch is so clearly defined in the editor's introduction of the *Nature-Study Review* and in his editorial to the symposium³ that there is no need of a restatement here. It is sufficient to say that it represented a return to the idea of an approach to the whole of the nature environment, biological and physical, industrial as well as pure science, from the standpoint of the child's interest in nature.

SUMMARY

In reviewing the history of nature-study teaching in the schools, from the standpoint of aim and method, some interesting facts were revealed. One of these facts was the constant shift in point of view. It was perfectly clear, throughout the entire period covered, that the main cause of the shift in viewpoint was due to a lack of any definite goal toward which the teacher felt the work was headed; and of any definite standards

² See McMurry, "Advisable Omissions from the Elementary Curriculum," *Educational Review*, XXVII, 478-93 (May, 1904).

³ *Nature-Study Review*, I, No. 1 (January, 1905).

except the most artificial, by which they could measure the degree of their success in the same manner as can the contractor, the merchant, the lawyer, the doctor, and other business and professional people of the world.

Again, it was made plain that the educational point of view of the elementary teacher and the point of view of the specialist in subject-matter are entirely different in type and content. The textbooks used in the schools were written by specialists in subject-matter and from the specialist's viewpoint in which the fundamental aim was that of mastering the subject. In every instance, regardless of the educational outlook of the teacher, her aim came under the dominating influence of the specialist, and this meant a shift from using the subject as a means to that of making it an end.

A still more striking fact which was clearly revealed in each movement was that in every period when the movement was in its formative stage the real educational results were of better quality than at any later stage in the period. In the beginning stages the subject-matter was poorly organized and looked upon with deep distrust by the specialist. On the other hand, as the period advanced subject-matter became better organized, more easily available to the teacher, more complete textbooks appeared, and the subject grew into the good graces of the specialists only to receive the condemnation of the educator. In other words, though it sounds like a paradox, the educational results were always most satisfactory at that stage when the work seemed jumbled and undefined, and least satisfactory when worked out into a well-organized system. At the unorganized, bookless stage the teacher was thrown upon her own resources, and although the work was frequently crude, it bore the stamp of personal effort, and contained an element of personality which is always needed to impart freshness to school work, whereas in the later stages where the teacher relied upon a textbook, this personal effort, and the vigor and freshness which goes with it were almost wholly lacking—the teacher and the work both were lifeless.

Again it was perfectly clear that teachers have little or no

notion of the special need of having children linger and loiter, without lagging, in an interesting way, for a considerable time with various objects and situations before attempting to use them in class discussion. It is this element of lingering with things that makes pets, potted plants, insect cages, aquaria, school gardens, and a host of other types of work interesting and profitable if rightly conducted.

Again, it was perfectly clear that people failed to appreciate, and fail to appreciate the fact at the present day, that it is impossible to train teachers in our normals and universities through a system of textbooks and libraries and expect them to go forth and do strong, vigorous, active, original work with children; working from the standpoint of children's interest when they have never worked from the standpoint of their own instinctive interests.

Again, one could not escape the fact, in searching out the story of nature-study teaching, that in all stages there were in various nooks and corners, working seemingly apart, attracting little or no attention, numerous quiet, self-sufficient, clear-sighted, sympathetic teachers, in touch with the children, generating and absorbing into the school work the interests of the children, and gaining from them vigorous and intelligent response. It is perfectly clear that the central ideas embodied in nature-teaching from the beginning, and which have rejuvenated it from time to time, namely an approach to the whole of the nature environment from the standpoint of the children's interests in nature, is as strong at the present day as at any past period, and that failure to realize the purpose, during a century of struggle, has been due to a misconception of the real aim of education and of the normal processes in learning.